DEVELOPMENT OF A DEEP OPERATIONAL ELECTRO-MAGNETIC TELEMETRY SYSTEM

- PROJECT OBJECTIVE
  - Develop a wireless, electro-magnetic (EM) telemetry system for use in deep natural gas and other high-temperature drilling beyond 20,000 feet and up to 392˚F (200˚C)
  - To be achieved in three interrelated phases:
    - Feasibility Assessment
    - Prototype Development
    - Field Testing and Commercialization

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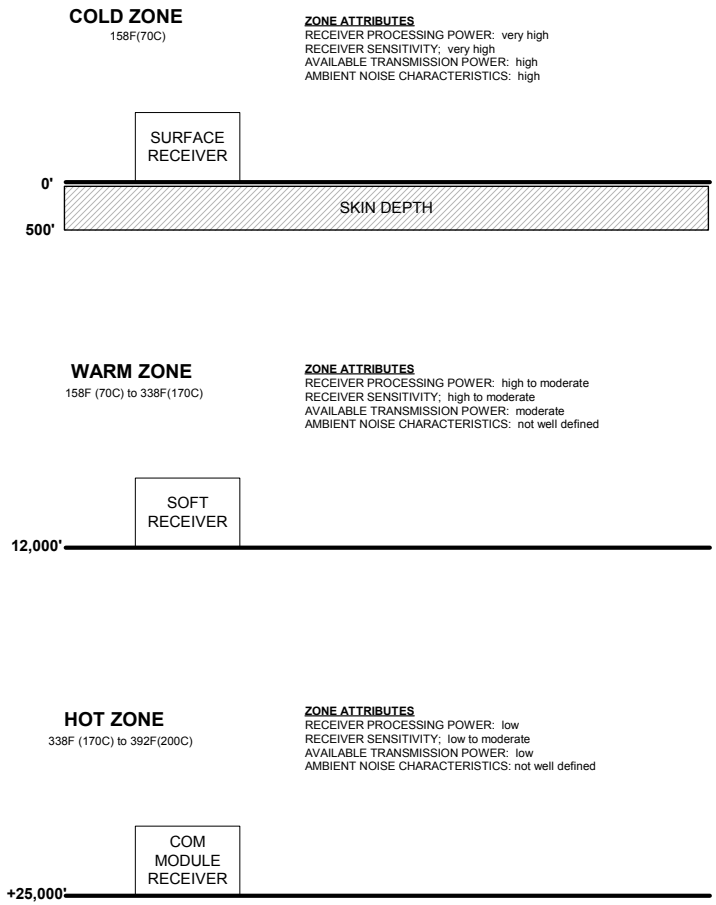
KEY SYSTEM COMPONENTS AND CONCEPTS

- Key components are being designed as stand-alone modules, using ruggedized mechanical packaging that will fit inside 1.25-inch O.D. pressure enclosures built within the drillstring:
  - Surface-Unit Receiver/Transmitter
  - Downhole Data-Acquisition Module
  - Downhole Repeater Module
  - Downhole Receiver/Transmitter Module



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- POTENTIAL FOR COMMERCIALIZATION
  - E-Spectrum Technologies has identified potential for a commercial market in Gas, Oil and Geothermal drilling industries for the commercial products based on the key components of this system:
    - Commercial Surface-Unit Receiver/Transmitter
    - Commercial Downhole Data-Acquisition Module
    - Commercial Downhole Repeater Module
    - Commercial Downhole Receiver/Transmitter Module
  - Data driven Commercial/Government prognostics is a target spin-off application for signal recovery/denoising algorithms developed under this effort

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- Potential Industrial Impact are derived from commercial versions of the EM Telemetry System:
  - Achieve improved drilling data collection through:
    - data measurement-while-drilling
    - Logging-while-drilling
    - Seismic-while-drilling,
  - Allow direct control of adjustable downhole tools as
    - kick-off subs
    - shock subs,
    - drillstring stabilizers from the rig floor.
- These capabilities would help to significantly reduce drilling costs, enhance wellbore productivity, and improve the safety of drilling for deep natural gas.